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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/786,707
Filing Date: February 25, 2004
Appellant(s): MA ET AL.

Ellington et al.
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 1/21/08 appealing from the Office action mailed 8/6/07.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,116,650	Bowser	5/1992
5,051,114	Nemser et al	9/1991
6,709,492	Spadaccini et al.	3/2004

7,041,154	Staroselsky et al	5/2006
WO 98/35739	Chao et al	8/1998
WO 02/11868	Sale et al.	2/2002

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 6-15 are directed to a method of making the non-porous membrane; claims 16-19 and 21-26 are directed to a fluid separator (membrane) comprising two membrane layers; claims 1-5 stand withdrawn.

DETAILED ACTION

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 16-19, 21-23 are rejected under 35 U.S.C. 102(b) as being anticipated by WO 98/35739 (hereinafter WO'739). The fluid separator having a composite membrane including one or a plurality of membrane layers (see Fig. 3, Fig. 1, abstract, and page 3, lines 15-28). The membrane substrate is also disclosed (Fig. 1, element 3). The membrane material, as claimed in claims 17-19 is disclosed by WO '739 as **fluoropolymer** (abstract, column 3, second paragraph). The membrane is further described as permselective capable of separating by diffusion, or non-porous (see page 4, lines 7-23).

Applying multiple coatings (layers) of the "same polymeric solution" to produce a ticker final membrane that safeguards against pinholes defects, as might occur if only a single coating is used, is disclosed in WO'739 (page 3, lines 21-28). By coating the first layer with a second layer of the same casting solution (e.g. same polymeric composition and solvent) the same seamless bonding structure is inherently produced, due to solvent penetration in the second layer.

The membrane of claims 16-19, although is made from a two coating process steps, as now claimed constitute a single membrane layer on a substrate, for layers made form the same polymer solution on a substrate (see Fig. 1, the layer thickness doe snot shows a seam).

As to claim 21, the final product structure is independent of the process of making, and achieving a "seamless boundary" can be obtained by casting the membrane solution in a single step, and increasing polymer concentration to increase the membrane thickness, or can be made by casting a sod or additional layers on the first membrane layers, to correct defects on the first coated layer, as discussed in the paragraphs above.

Claims 16-18 are rejected under 35 U.S.C. 102 as being anticipated by (WO 02/11868). WO'968 teaches a membrane with multiple layers and a first layer on top of a support; the membrane is formed on to a support, and is made of a fluoropolymer, e.g. PTFE (Abstract, fig.1, claims 1-3). The layers are made by co-casting the layers simultaneously and the layers can be made from the same polymeric dope composition,

the process produces a seamless bonding between layers (abstract, page 12, line 25-29, Fig. 5). These claims do not exclude the membrane with porous layers.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 6-14, 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 98/35739 (hereinafter WO'739), discussed above in view of Nemser et al (US 5,051,114), and alternatively in view of Bowser (US 5,116, 650).

WO'739, discussed above teach making a composite membrane made from glassy perfluorodioxole copolymer, and including multiple layers on a substrate (abstract, page 3, lines 3-28). WO'739 teaches that when membrane layers thicker than 0.5-6 micron are desired, multiple coating may be applied, which also protect the membrane against pinholes defects (see page 3, lines 26-28).

WO'739 further teaches the process of making the composite membrane as known in the art (see page 3, last paragraph bridging page 4, lines 1-6). The later sections incorporate Nemser et al and Bowser for teaching the conventional processes by which the membrane can be made of, these references ('114 and '650) are cumulative.

Nemser et al ('114) teaches making the membrane by solvent casting (abstract, examples III-IX; abstract, column 4, lines 49-68, column 6, third paragraph; see column 8, lines 38-52, column 10, last paragraph, bridging column 11); this reference teaches

heating the membrane layer at a temperature of 100-150 degree C to dry the membrane layer.

Using the coating conditions, e.g solvent casting at the suggested temperature conditions for each of the layers, in the multilayer structure of WO '739 would have been obvious to one skilled in the art at the time this invention was made, to correct membrane defects or pinholes, as suggested in WO'739. Because the further coatings membrane making solution is the same in the suggested multicasting or multilayers coating in 'WO'749, the bonding between layers is due to solvent bonding, as in present application, and therefore "seamless boundary" should have been predicted by the skilled artisan, when the support, as suggested in '114 is heated at high temperature.

Bowser (US 5,116, 650) is also cumulative, and teaches coating by applying the coating solution by any convenient means to for the membrane layer, and further evaporating the solvent by any convenient means and drying the membrane; dip coating is further suggested (column 2, lines 9-29, and column 5, first paragraph).

WO'739 teaches that when membrane layers thicker than 0.5-6 micron are desired, multiple coating may be applied, which also protect the membrane against pinholes defects (see page 3, lines 26-28).

Based on the incorporation of patent '650, drying the first layer and further applying the further layer to increase membrane thickness and correct membrane defects, as suggested in WO'739 would have been obvious to one skilled in the art at the time this invention was made, as discussed above, for multiple coating of the same polymeric solution, the solvent bonding between layers is predictable by the skilled artisan.

As to claim 6, forming multiple layers, or multiple coating is disclosed in 'WO'739, and the drying conditions are disclosed in Nemser et al, as discussed above. Repeating the same process conditions to form multiple layers, e.g to increase membrane thickness it would have been obvious to one skilled in the art at the time this invention was made, based on the suggestions of the WO'739. Furthermore, applying a further coating of the same membrane composition on top of the first membrane layer, which includes the same solvent composition for the "same" polymer, inherently partly dissolves the surface of the first membrane layer, due to solvent diffusion though the first membrane layer creating bonding between the membrane layers.

It would have been obvious to one skilled in the art at the time this invention was made to make the multiple coating membrane as suggested in 'WO 739 by applying successive layers to a first coated membrane made by the process of Nemser ('114), e.g. to increase the membrane thickness, since WO'739 teaches forming the layers by "solvent casting process", as disclosed in the'114 patent. Reference WO'739 teaches that if layers thicker than 0.5-6 micron are required multiple coatings may be applied. The '650 reference teaches applying a coating after drying a first coating on a substrate (see examples 1-3). It would have been obvious to apply the concept of using a dried composite support as base for the multilayer membrane or dry the first layer before the application of a subsequent layer(s) in WO'0739 base on its teaching of using the '650 method for making the multilayer non-porous membrane. Selecting a desire thickness for each of the coated layer to produce a final desire final membrane thickness it would have also been obvious to one skilled in this art, e.g. by controlling the coating material

viscosity to produce the desire thickness, or by applying multiple layers to reach to the desire thickness, as suggested in WO'739.

As to claims 8, 25-26 partially dissolving a portion of the first membrane layer is not expressly disclosed by the references above, however, by dissolving the polymer in the same solvent, and with the two layer made from the same polymer, one skilled in the art at the time this invention was made can expect a slight dissolution of the first layer e.g. allowing bonding between the layers, and an inherent degree of continuity between the membranes layers, e.g. seamless boundary.

As to claims 9-10, the fluorosolvent disclosed in Nemser et al ('114) seems to meet the boiling point conditions required, e.g. FC-75.

Regarding claim 12, the drying time is directly related to the membrane thickness, it would have been obvious to one skilled in the art at the time this invention was made to dry a membrane layer having a low thickness at the temperature conditions suggested by Nemser et al, an reduce the membrane drying time to avoid energy lost, or alternatively select the drying and temperature time to provide the final membrane with a desire permeability; selectivity is not affected by the temperature treatment (see '114, column 13, lines 9-16).

As to claims 13 and 14, applicant admits rolling coating as conventional (see specification, paragraph 28). One skilled in the art can expect thinner films formation with the conventional rolling process. Patent '114 teaches the use of the membrane in oxygen permeation processes ((see table 10).

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over WO 98/35739 (hereinafter WO'739) in view of Nemser et al (US 5,051,114), as applied to claim 6 above, and further in view of Spadaccini et al (US 6709,492) or Staroselski et al (US 7,041,154). WO'739 and patent '114 fail to teach using the membrane in a fuel deoxygenator of an aircraft.

Patent '492 teach using membranes selective to oxygen and made form perfluorinated glassy polymers in aircraft systems (abstract, column 4, lines 6-13).

Patent '154 teaches also teaches using oxygen permeable composite membrane in deoxygenator system of an aircraft (abstract, element 42, column 3, lines 21-49).

It would have been obvious to one skilled in the art at the time this invention was made to use the membrane of WO'739, and /or Nemser et al ('114) to separate gas by diffusion in the oxygenator system of "492 or '154, based on membrane properties and high oxygen permeability and selectivity.

Response to Arguments

Applicant's arguments filed 1/18/07 have been fully considered but they are not persuasive. WO'739 teaches making the membrane by conventional "solution casting" (solvent casting) techniques (page 3, lines 15-30 and column 4, lines 1-3), as disclosed in present application disclosure (page 3 last paragraph). Claim 16 and dependent claims are product and not process claims, therefore, whether the multilayer membrane is made with the first membrane layer wet or dried, the final membrane can includes a multilayer bonded by the solvent from the second layer deposited on the first membrane layer membrane. If the membrane in WO'739 is made while the first layer is wet, a

"seamless boundary" is formed due to the contact between the layer and the polymer diffusion, so that the layer can be dried as a single thicker layer. Since the solvent diffusion between layers in wet layer is higher, a marking line or seam between layers is not significant or is not present.

Regarding claim 6 and dependent claims, the embodiments including multilayer is though to be made by conventional solvent casting, as in reference 5,116, 650, incorporated by reference, which teaches casting the fluoropolymer solution on a dried composite support, as discussed in the 103 rejection above. Alternative embodiments, in which the membrane is alternatively cast on a first coating without drying are also considered in the WO'079 reference (see the incorporation by reference), e.g. conventional coating processes.

Nemser teaches the casting and drying conditions required for the dioxoles layer formation, and although one layer is caste in Nemser, reference WO'739 teaches that if layers thicker than 0.5-6 micron are required multiple coatings may be applied. Therefore, the combination of multiple layers of the same polymer casting solution on a support either pre-drying the first layer or not are disclosed in the combination of references.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in

the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the teaching to provide additional membrane layers to reach a desired thickness either by drying a first layer before coating the second layer, or by successive coating without drying between steps are suggested in WO'739, e.g. conventional solvent casting of multilayer coating on a support, see the incorporation by reference of different casting processes. The rejection in the prior Office action is maintained. Bowser is discussed as part of the disclosure of WO739, which incorporates its teaching.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

(10) Response to Argument

Applicant argues with regards to the rejection under 102 that references WO'739 and WO'868 do not teach the "indistinct, seamless boundary" between the two membrane layers. The rejection under 102 of the product or separator membrane is considered proper because the membrane is not limited to a process of making and can be considered continuous between the layers if the membrane is made while the first layer is still wet, as in the co-casting process of WO'968. The membrane as discussed in the rejection above can be seamless also if the first layer is dried, and the second layers has the same membrane composition, e.g due to the effect of the solvent on the first layer e.g. bonding by dissolving.

The process of producing the second layer is done in a wet state, e.g. conventional methods, such as, immersion, dip coating solvent casting) which does not produces demarcation between the layers, or distinction between the formed layers, and WO'739 does not appear to limit the coating process to an specific method.

The membrane used in the fluid separator of claim 16 does not exclude porous membranes, therefore the rejection based on WO'968 is proper.

Applicant's membrane (claim 6) is made with an intermediate drying between coating steps, which allegedly "does" produce a demarcation or boundary between the formed layers, and discontinuity between the layers. Applicant's specification discloses the process of making the membrane as "solvent casting" (page 7, last paragraph); as in the prior art discussed above. applicant also corrects the same problems as in the prior art (WO'739) (see specification, paragraphs 27-29).

Applicant argues the combination of WO'739 with Nemser or Bowser in the rejection of claim 6. WO'739, as discussed in the Office action, teaches performing multiple coating steps to increase membrane up to a desire thickness, therefore, providing further layer of membranes on the membranes of Nemser to produce a composite membrane would have been obvious to the skilled artisan, e.g to correct defects (pinholes), that may be present on the membrane, producing a leak free membrane. Bowser ('650) teahes the alternative of drying between coating stages, as discussed in the Office action. By drying the first membrane coated layer, to remove the solvent, and further coating a second layer containing the same membrane/solvent coating on the dried membrane, the skilled artisan can predict that solvent present in the second coating solution will dissolve part of the first layer to adhered the second layer to the first layer by solvent in bonding, which appears to be inherent in the membrane of WO'749. The later reference teaches making the membrane by the process of patent '114, which dry the first coated layer at the temperature that covers the range in current claims, as discussed in the rejection above.

Although we appreciated that individual defects of the reference or patent claims can defeat the rejection, we do not find the rejection overcome by pointing out that one reference does not contain a particular teaching, when the reliance for that teaching was on another "reference". In re Lyons, 53 CCPA 1514; 364 F2d 1005; 150 USPQ 741. The additional support for drying between stages found in Bowser ('650).

Furthermore, selecting pre-made, dried membranes as support for composite membranes is conventional in the art. Applicant fails to clearly respond to the question

of how an indistinct seamless boundary can be produced between layers, when there is a heating step in between steps, and in general what is novel in the apparatus or process of making of claim 6 and 16, and dependent claims. From the specification, it is clear that the **seamless boundary** is produced by dissolving a portion of the first layer (see specification paragraphs 37-43).

Because the membrane in WO'739 is suggested to be made by the process of '114, which includes drying of the layer, the skilled artisan can predict that based on that, if the first layer, made at the thickness suggested in WO'749, results with leakage or pinholes, in particular for the lower thickness range, one or more additional layers of the same solution can be coated on the first membrane to reach to the desired thickness, as also required in WO'749, causing the bonding between layers required in present invention, as results of the dissolution of a portion of the first layer by the solvent in the second coating, therefore, the bonding with "indistinct seamless boundary" appears to be inherent in a process where the second coating includes the same composition as the first coating, as in the multilayer structure of WO'749.

References '114 and '650 provide the bases for the process of making the membrane, e.g. solvent casting on a support, temperature conditions, etc, which references are part of the disclosure of WO'749 (see page 3, second paragraph).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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